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Zhu

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(54) **R.F. SUPPRESSION TECHNIQUE FOR COLLECTIVE OBJECTS MANAGEMENT SYSTEM USING R.F. OBJECT IDENTIFICATION**

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(52) **U.S. Cl.** **340/570**; 340/572.1; 340/815.4

(58) **Field of Search** 340/825.49, 540, 340/572.4, 570, 691.1, 691.6, 691.8, 815.45, 815.9, 539, 815.4, 635, 572.1, 572.2, 572.3; 327/187; 326/104, 125

(56) **References Cited**

U.S. PATENT DOCUMENTS

RE31,643	E *	8/1984	Waldman	179/81
5,038,059	A *	8/1991	Ebzery et al.	327/217
5,287,414	A *	2/1994	Foster	382/100
5,424,858	A *	6/1995	Gillotte	398/108
5,721,531	A *	2/1998	Garver et al.	340/825.49
5,742,231	A *	4/1998	Kolodin	340/541
5,977,875	A *	11/1999	Lin et al.	340/570
6,348,864	B1 *	2/2002	Lin et al.	340/570

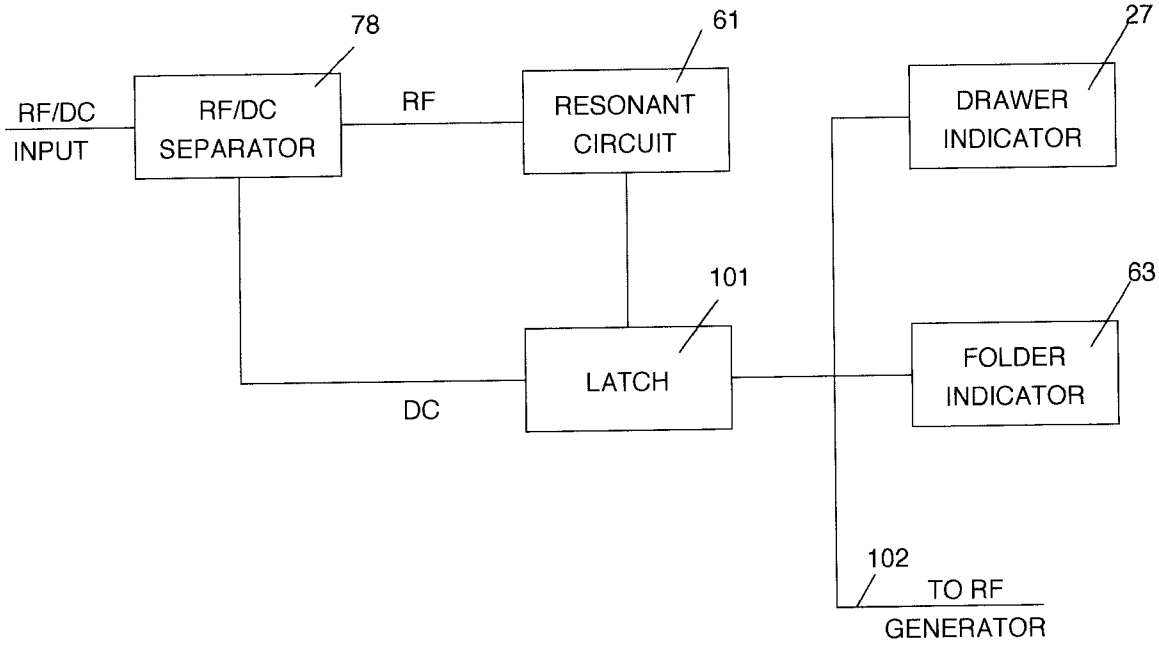
* cited by examiner

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(57) **ABSTRACT**

A collective objects management system for objects such as documents contained in file folders in drawers of file cabinets. Each file folder has an electrical circuit with a visible indicator mounted on the file folder. Each folder circuit has a crystal which is responsive to an R.F. signal of a specific frequency, the frequency being different for each folder circuit. An associated computer operates an R.F. signal generator to produce an R.F. signal at the frequency of the particular folder circuit of the file folder selected for retrieval. To aid the user, each file drawer has a visible indicator mounted on the front panel, the panel indicator being illuminated when the sought folder is contained in that drawer. Each folder circuit includes a latch having an input coupled to the respective crystal and an output coupled to the associated indicator, the latch being responsive to the resonant state of the crystal for activating the indicator and for providing a resonant state feedback signal for terminating the r.f. signal. The R.F. signal generator can be operated in a sweep mode for checking the integrity of the file. A collective objects management system can be applied to a wide variety of collective objects management systems, such as supermarkets, automobile parts distributors, and various manufacturing operations.

12 Claims, 8 Drawing Sheets



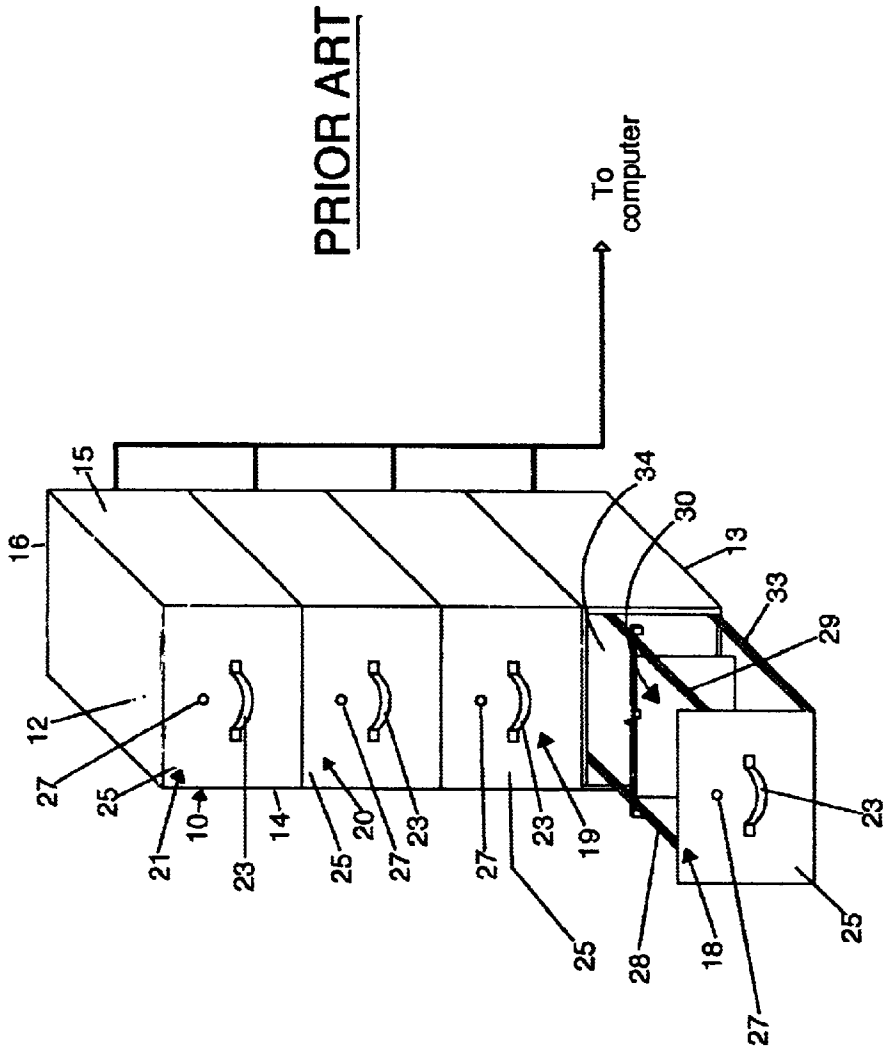

PRIOR ART
To computer
15
16
12
27
25
21
10
23
14
25
20
27
23
27
23
19
25
28
18
27
34
30
13
33
29
23
25

FIG.1

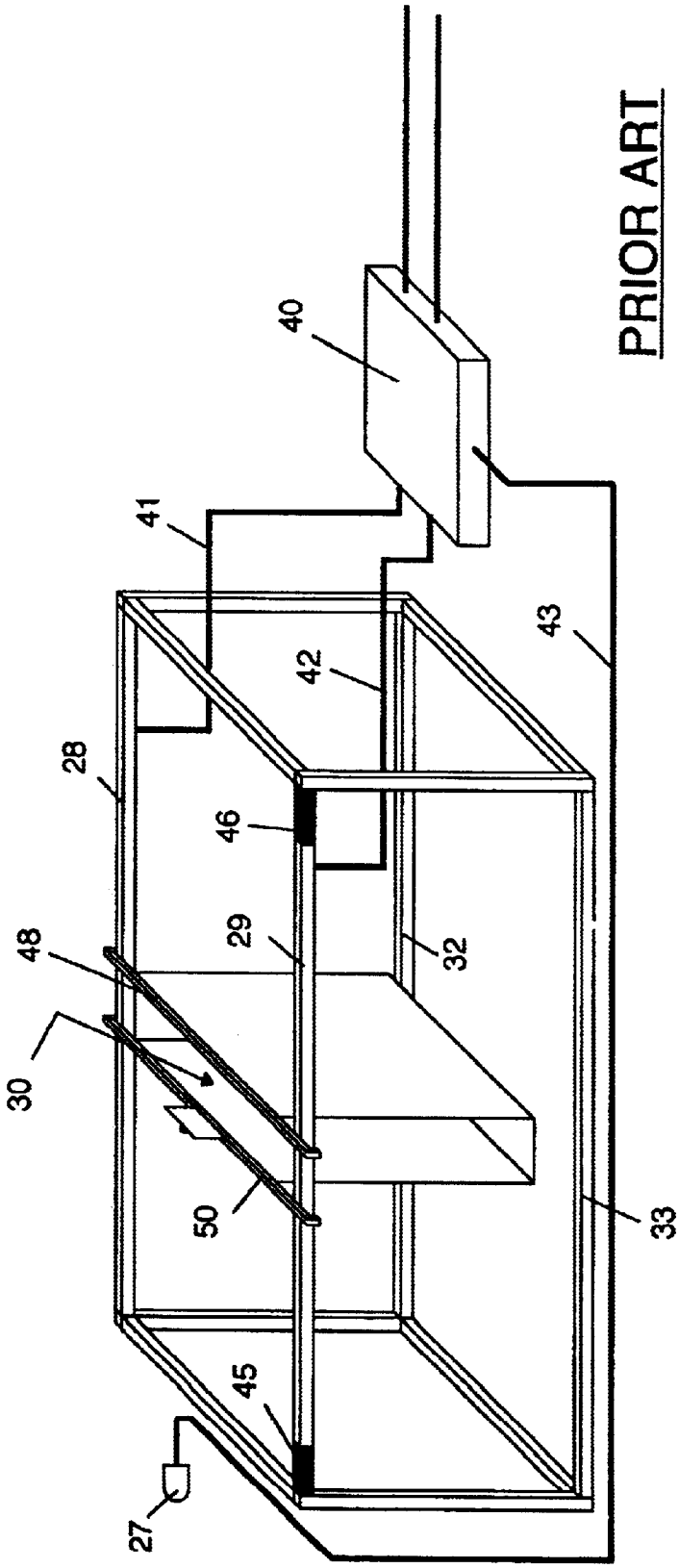
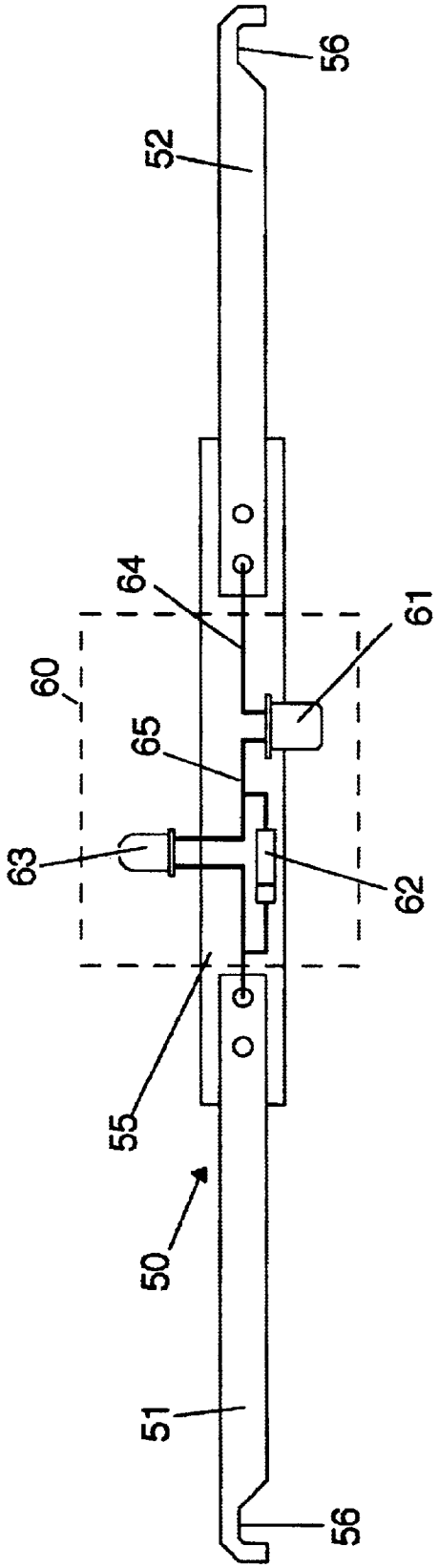


FIG.2



PRIOR ART

FIG.3

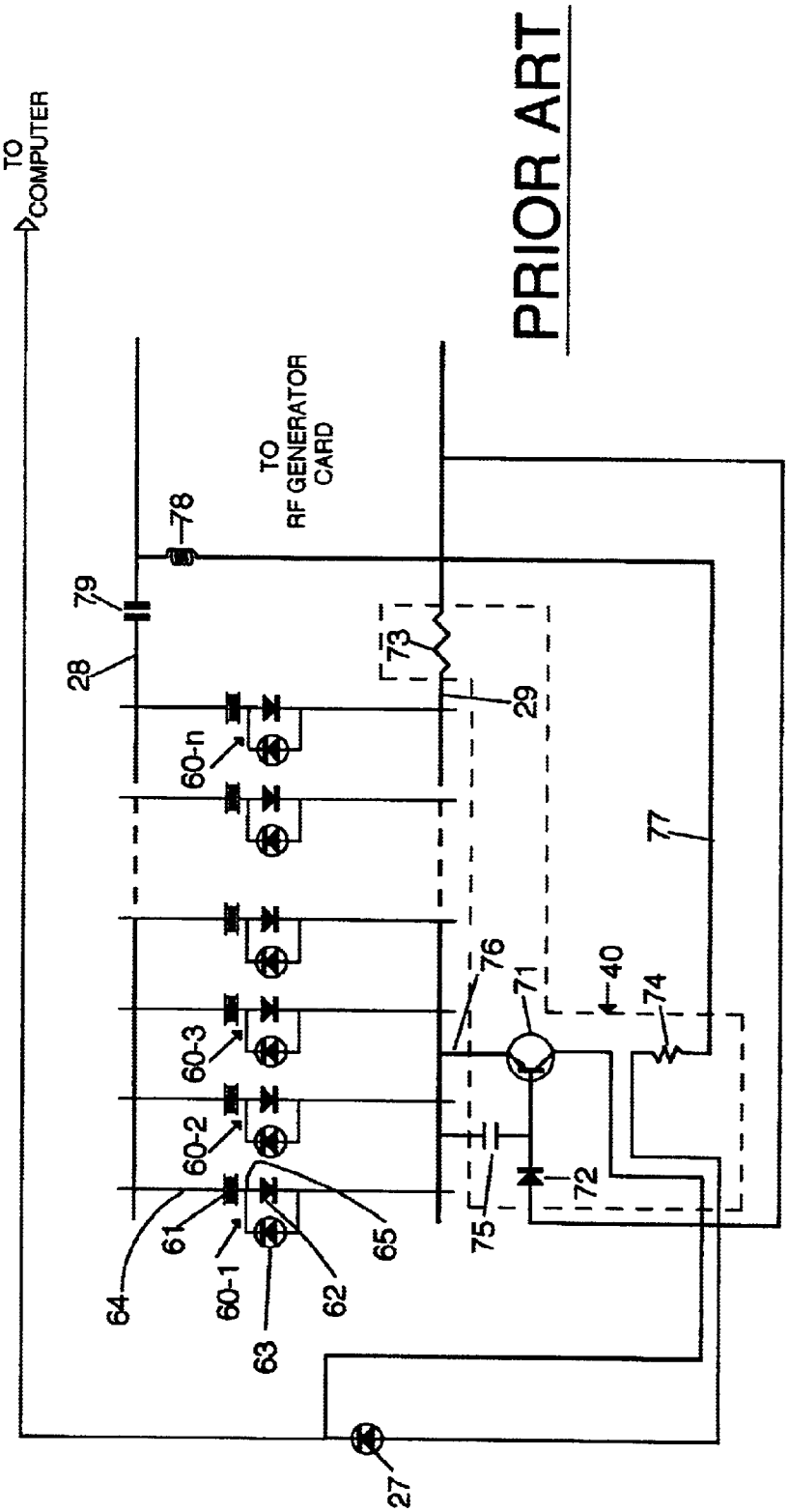

PRIOR ART
TO COMPUTER
TO RF GENERATOR CARD
78
79
28
73
29
60-n
77
76
71
40
74
60-3
60-2
72
61
65
75
64
60-1
62
63
27

FIG.4

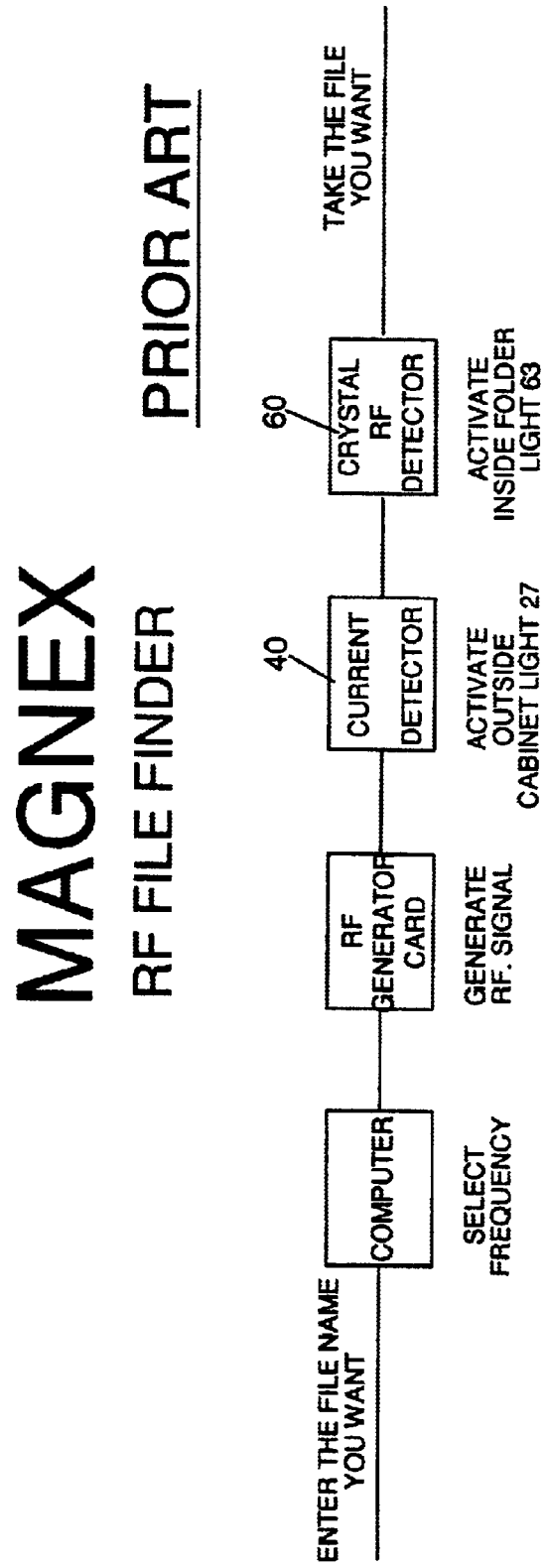

MAGNEX
RF FILE FINDER
PRIOR ART
ENTER THE FILE NAME YOU WANT
COMPUTER
SELECT FREQUENCY
RF GENERATOR CARD
GENERATE RF. SIGNAL
40
CURRENT DETECTOR
ACTIVATE OUTSIDE CABINET LIGHT 27
60
CRYSTAL RF DETECTOR
ACTIVATE INSIDE FOLDER LIGHT 63
TAKE THE FILE YOU WANT

FIG.5

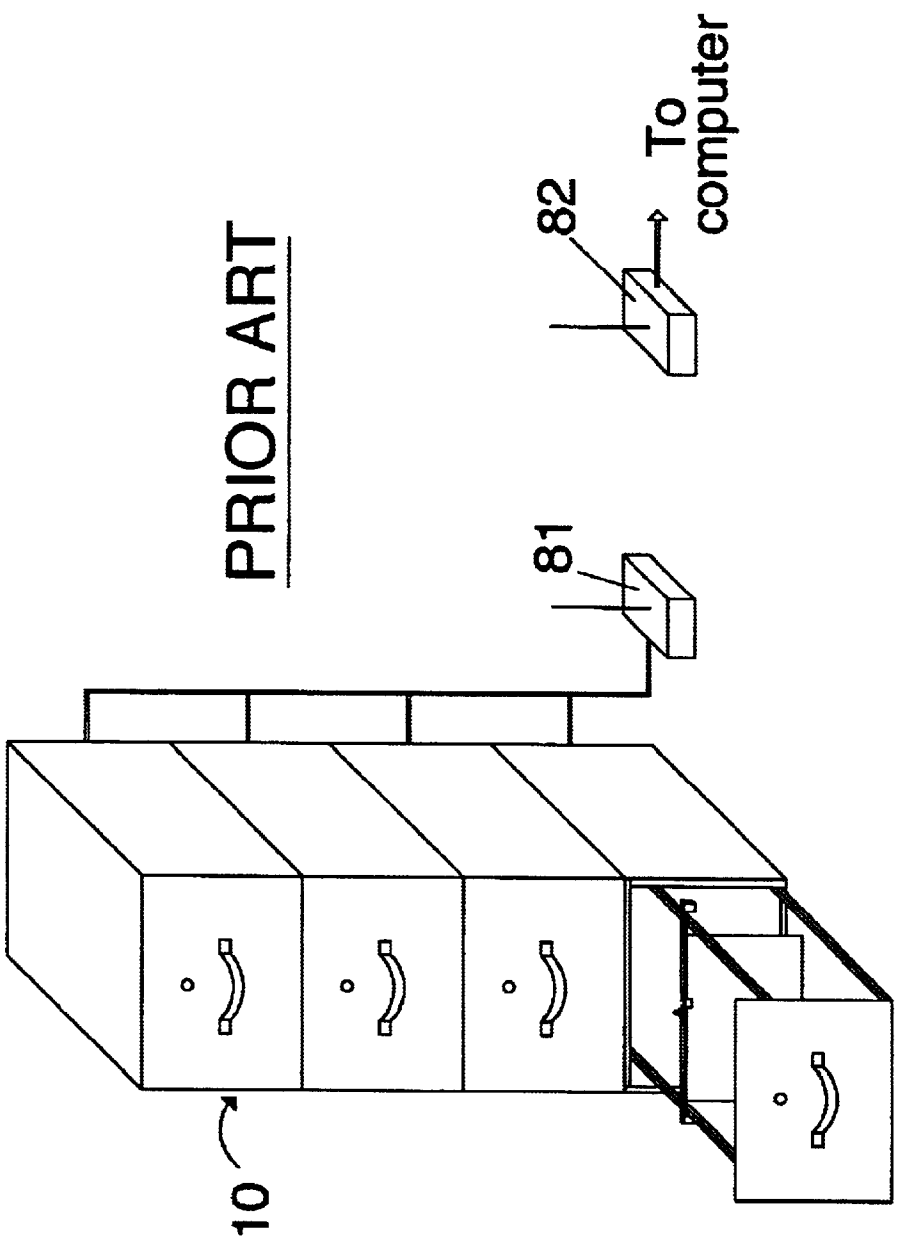


FIG.6

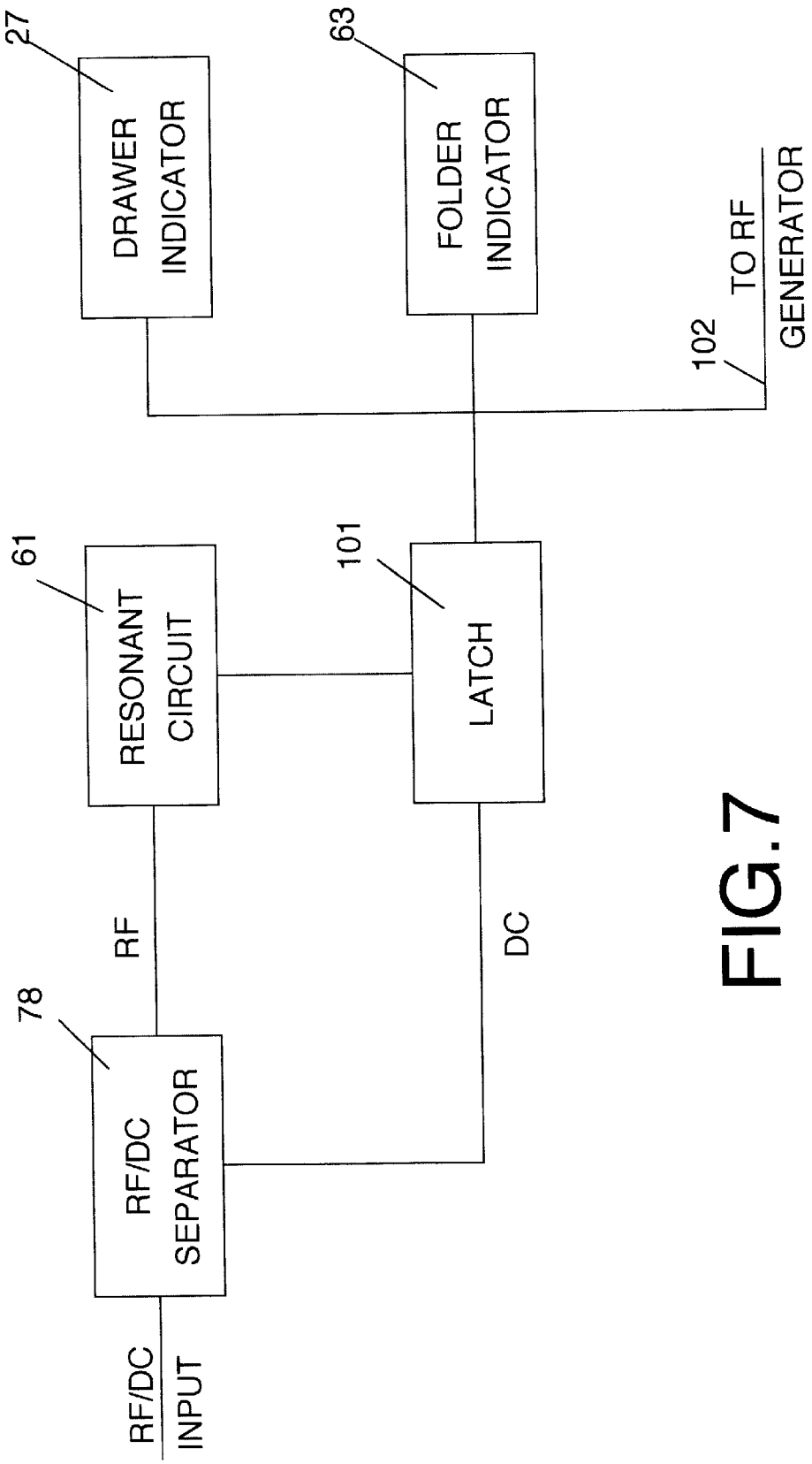

27
DRAWER INDICATOR
63
FOLDER INDICATOR
102
TO RF GENERATOR
61
RESONANT CIRCUIT
101
LATCH
RF
DC
78
RF/DC SEPARATOR
RF/DC INPUT

FIG.7

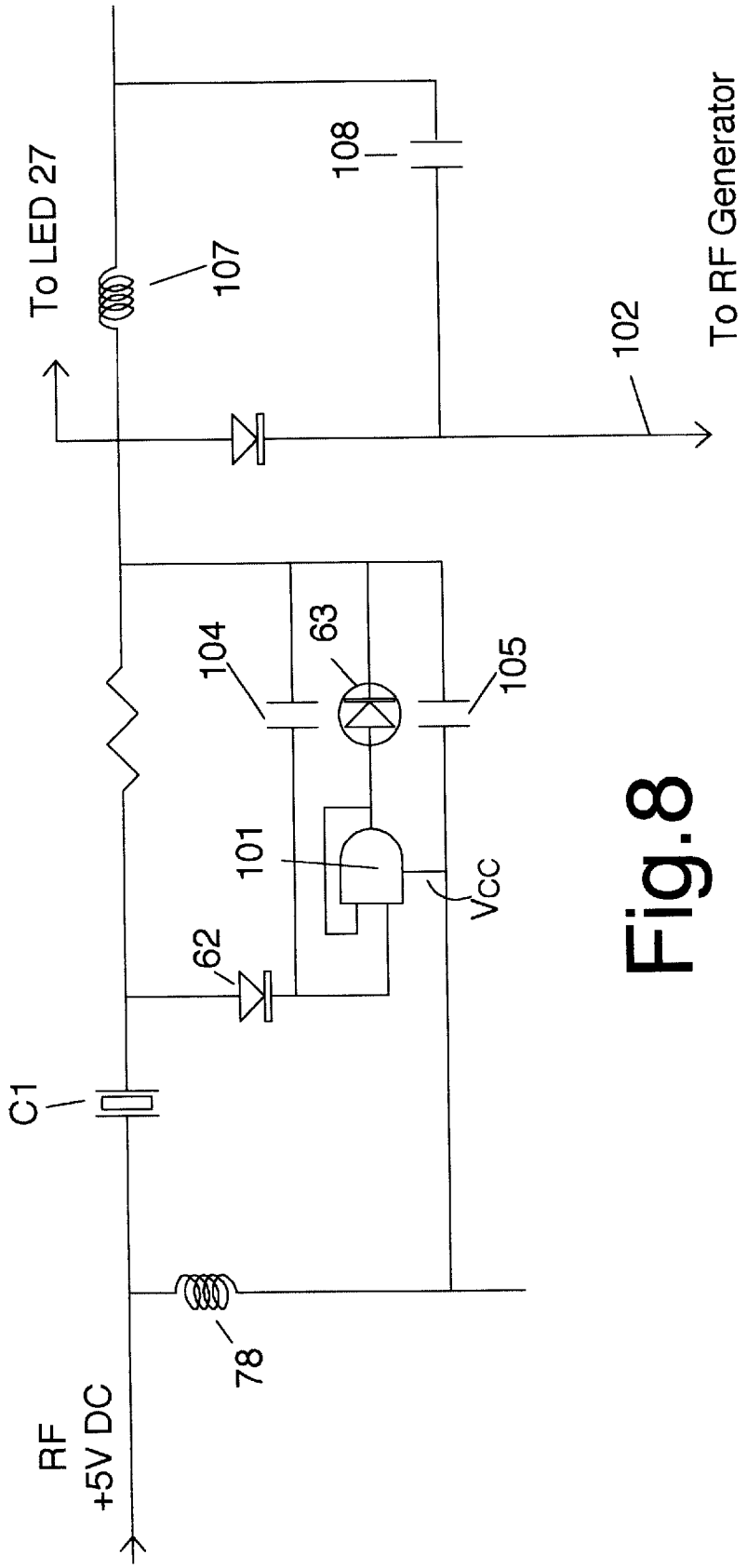

To LED 27
107
108
102
To RF Generator
104
63
105
101
Vcc
62
C1
78
RF
+5V DC

Fig.8

R.F. SUPPRESSION TECHNIQUE FOR COLLECTIVE OBJECTS MANAGEMENT SYSTEM USING R.F. OBJECT IDENTIFICATION

BACKGROUND OF THE INVENTION

This invention relates to collective objects management systems in general, and in particular to an r.f. suppression technique for a collective objects management system using R.F. object identification.

The term "collective objects management systems" is a term coined to denote systems for generally keeping track of items ("objects") in a collection of items. For example, an automobile parts warehouse at any given time has a collection of vehicle parts ("objects") in inventory. The kind and number of such parts varies every day, as parts are sold and new parts are received. In order to keep track of the number and kind of vehicle parts in inventory, some type of collective vehicle parts management system must be used. Similarly, in a semiconductor manufacturing operation, at any given time there is a collection of integrated circuits ("objects") of one or more types located somewhere in the facility, which must be accounted for using a collective integrated circuits management system. In supermarkets, a collection of a large number of different types of items, such as meats, produce, canned goods and the like is usually in inventory, with the number and types of objects varying widely on a daily basis and thus requiring a complex objects management system. In business offices and some homes, file storage cabinets are typically used to store documents used for both business and personal activities. A typical file storage cabinet has several pull-out drawers each containing a relatively large number of file folders ("objects"), with each folder containing one or more documents. In order to enable the documents contained in the various files to be readily accessed, some type of file management system is necessary.

In the case of file storage management, each file folder is typically provided with a tab portion visible when the file drawer is opened (usually along the upper edge of the folder) and containing readable information describing the content of the folder. The readable information is typically a short form of identification, such as an account name, a subject name (e.g., "Utilities Bills") or the like.

In order to provide ready access to the individual documents contained in the folders, some type of indexing arrangement is normally used to identify the drawer location of each folder. A simple technique commonly employed is an alphabetical index card placed on the front panel of each drawer listing the file folders in alphabetical order. For example, one file drawer panel might have an index card listing files starting with the letters A–F, another drawer might have an index card listing files starting with the letters G–L, etc. Frequently, more sophisticated indexing arrangements are used, such as a computer-based index listing all files by a short form identifier and a corresponding enlarged and more thorough description of the file contents. Even such computer-based arrangements still require the use of a readable tab or tag on each file folder in order to identify a given folder to a user. This is highly undesirable, since it facilitates the search by any unauthorized user for a specific file name or for a file containing information of a particular type. Nevertheless, known file management systems require the use of visible tabs or tags in order for the files to be reasonably locatable.

In those applications in which several individuals have access to the file drawer contents, some arrangement is usually made to monitor the disposition of the files. For example, in a business application, it is convenient and sometimes necessary to provide a sign out and return procedure so that the whereabouts of a given file will always be known. Usually, such monitoring attempts fail to accurately track the files because of the failure of individuals to faithfully follow the procedure. Consequently, at any given time, the integrity of the file management system can only be verified by actually looking through each file drawer and checking the file folders and their contents with the master index. This requirement is both time-consuming and burdensome, and thus a severe disadvantage.

In known file management systems of the type described above, once a file folder is provided with a contents identifier, that folder is permanently associated with the nature of its contents. To change the contents to some other category, the folder must either be thrown away and a new, unmarked folder substituted in its place, or the identification label must be changed. In addition, the master index must be up-dated, either manually or by using the computer in a computer-based indexing system. These procedures are not always followed by office personnel, and the integrity of the files system is consequently compromised.

In all examples of known collective objects management systems, either the containers for the different objects or the objects themselves are usually provided with some type of human readable or machine readable identification indicia, such as a label or tag affixed to the object or the container. In more sophisticated systems, a computer is used to assist in keeping track of the objects. When an object is removed from the usual location, some procedure is typically used to note the fact that object has been removed from its normal location. This is accomplished either by operator entry of the change into the system computer, or by using tag or label reading devices (e.g., bar code readers) to enter the information into the system computer. All known systems suffer from disadvantages similar to those noted above with file management systems. In addition, none provides a simple and efficient way to find a desired object stored somewhere in a large collection of different objects.

Commonly assigned U.S. Pat. No. 5,977,875, issued Nov. 2, 1999 for "Collective Objects Management System Using R.F. Object Identification" discloses and claims a collective objects management system which is devoid of the above-noted limitations and disadvantages, which can be implemented using standard object containers of known design, and which has several features absent from known collective objects management systems.

The patented invention comprises a collective objects management system which uses R.F. sensitive circuits to maintain control of all objects in a collection. Each object has an associated R.F. sensitive circuit which resonates at a unique frequency when an R.F. signal at that unique frequency is received by the circuit, and an indicator coupled to the R.F. circuit for identifying the object to a human operator. The indicator is preferably a visible indicator-such as an LED-coupled to the object or the container for the object and which can readily be seen by a human operator.

In a specific implementation of the invention to a file management system, a folder circuit is included in each file folder to be placed in a file drawer. Each folder circuit has a crystal responsive to a particular R.F. frequency, with the resonant frequency of a given crystal different from all the other crystals. Each folder circuit is electrically coupled to

a drawer signal input/output using the electrically conductive upper support rails usually found in conventional file cabinets. One of the rails is modified by electrically isolating that rail from the remaining electrically conductive elements in the drawer.

Each folder circuit includes an indicator, preferably an LED visible indicator, mounted along the upper margin of the folder in a location visible to a user when the drawer is opened. In addition, each drawer is provided with an indicator, preferable a flashing LED visible indicator, mounted on the front panel of the drawer. A current detector circuit is used to control the state of the drawer panel indicator.

All drawer input/output terminals are electrically coupled in parallel to an associated computer, either using dedicated connectors (i.e., hard wired) or transceivers (i.e., wireless communication). The computer includes an R.F. signal generator capable of generating signals matching all the crystal frequencies. To find a file, a user specifies that file to the computer, typically by using a keyboard or a mouse. The computer causes the R.F. signal generator to generate an R.F. signal whose frequency matches that of the specified file. The R.F. signal is transmitted to all the file cabinets in the system, and thus to all the file drawers. If the specified file is located in any one of the drawers, the indicator of the drawer containing that file folder, and the indicator of the correct file folder, are both activated. The user then opens the drawer with the active indicator and removes the file folder with the active indicator.

As applied to a file management system, the patented invention eliminates the need for readable tabs or tags on each file folder, since the correct file is designated by the activated indicator. Also, the nature of a file folder can be changed by simply entering the necessary information into the computer. In addition, the integrity of the entire file system can be checked by using an R.F. sweep frequency generator to sweep the entire frequency range of crystal frequencies and detecting any frequency for which a resonant response is absent. The patented invention can be readily and conveniently incorporated into existing file cabinets having the electrically conductive dual rail folder support mechanism.

A potential obstacle to the full use of the patented invention lies in governmental restrictions on the amount of r.f. radiation permitted to be emanated by commercial devices. Many governmental entities (such as the FCC in the United States of America) restrict the amount of such radiation which can be emitted by commercially-sold products. In the patented invention described above, once the drawer containing the sought file folder is opened, the r.f. radiation associated to the conductive rails within the drawer is free to escape beyond the confines of the metal cabinet. While this may pose no real danger to users of the device, this free radiation may nevertheless violate government requirements.

SUMMARY OF THE INVENTION

The invention comprises an r.f. suppression technique which eliminates the emanation of r.f. radiation once the correct object has been identified using the r.f. object identification system and method described above.

In the broadest aspect, the invention comprises an improvement in a system for managing objects distributed in an object location space, the system comprising a receptacle for a plurality of objects, the receptacle having a pair of electrically conductive members; a pair of electrically conductive signal leads coupled to the pair of electrically conductive members; and a plurality of r.f. circuits each associated to a different one of the objects, each of the plurality of r.f. circuits having a pair of electrically conductive terminals in electrical contact with the electrically conductive members when the associated object is located in the receptacle, a crystal resonant at a specific frequency and an indicator activated whenever the associated crystal detects an r.f. signal at the specific frequency of that crystal, the resonant frequency of each of the crystals being different from the remaining ones of the crystals so that an r.f. signal applied to the pair of electrically conductive signal leads causes only one of the plurality of crystals to resonate and only the associated indicator to be activated. The improvement to such a system comprises a modification such that each of the plurality of r.f. circuits includes a latch having an input coupled to the respective crystal and an output coupled to the associated indicator, the latch being responsive to the resonant state of the crystal for activating the indicator and for providing a resonant state feedback signal for terminating the generation of the r.f. signal.

The indicator is preferably a visible indicator, such as an LED. The object location space preferably comprises a file cabinet and the objects are file folders.

For a fuller understanding of the nature and advantages of the invention, reference should be made to the ensuing detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a multiple drawer file cabinet incorporating the invention disclosed and claimed in the '875 patent referenced above;

FIG. **2** is a schematic side perspective view of a single file drawer and file folder;

FIG. **3** is a side elevational view of the electrical components located at the file folder;

FIG. **4** is a schematic diagram of the R.F circuitry located at the file cabinet;

FIG. **5** is a flow chart illustrating use of the invention disclosed and claimed in the '875 patent;

FIG. **6** is a perspective view of a multiple drawer file cabinet in a wireless embodiment of the invention disclosed and claimed in the '875 patent;

FIG. **7** is a block diagram of the preferred embodiment of the R.F. suppression technique invention disclosed and claimed herein; and

FIG. **8** is a circuit diagram of the preferred embodiment of the invention disclosed and claimed herein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention has wide application to a large variety of collective object management systems. The following is a detailed description of one application of the invention in the field of file management systems.

Turning now to the drawings, FIG. **1** is a perspective view, taken from the right front, of a first embodiment of the invention disclosed and claimed in the '875 patent and using direct electrical connections between the file cabinets and the associated computer. As seen in this Fig., a multiple drawer file cabinet **10** (four drawers illustrated) of known mechanical construction has the usual top **12**, bottom **13**, sides **14**, **15**, and back **16**. Four drawers **18–21** are slidably

mounted in cabinet **10**, each drawer **18–21** having a drawer pull **23** mounted on a front panel **25** thereof. A visible indicator device **27** is also mounted on the front panel **25** of each drawer **18–21**. Indicator **27** may comprise any one of a number of known elements capable of providing a visible signal when activated in the manner described below. Examples of suitable indicators are a conventional LED indicator, and a type 276-036 flashing LED indicator available from Radio Shack Corporation.

Lowermost drawer **18** is shown in the opened position in order to provide a perspective view of the basic drawer structure and the manner in which a file folder is removably supported in a file drawer. As shown, drawer **18** is provided with a pair of upper support rails **28**, **29**, which serve the primary purpose of supporting individual file folders, such as file folder **30**, in the drawer. Secondarily, rails **28**, **29** may also provide structural rigidity for the drawer **18** itself. Drawer **18** also has a pair of lower rails **32**, **33** (only one of which is visible in FIG. **1**) which complete the horizontal structural elements. In a commonly used file cabinet structure, rails **28**, **29**, **32**, and **33** may form an inner frame insert (along with vertically arranged frame members) which can be physically installed in a standard drawer. To complete the drawer structure, a back **34** is connected to the rails **28**, **29**, **32**, **33**. All file folders, such as folder **30**, are removably supported by upper rails **28**, **29** using horizontal support braces **35**, **36**, to which the folder **30** is mechanically secured. The mechanical structure of folder **30** and rails **28**, **29** is conventional. The structure and arrangement of drawers **19–21** are identical to that of drawer **18**.

As best shown in FIG. **2**, each one of the upper pair of support rails **28**, **29** of each drawer **18–21**, as well as the drawer indicator **27**, are electrically connected to an associated computer via a separate current detector circuit **40** located in any convenient location in the respective drawer. Stated differently, each drawer has its own current detector **40**. Each current detector **40** functions in the manner described below. In FIG. **2**, left rail **28**, right rail **29**, and indicator **27** are each electrically connected to current detector **40** by conductive wires **41**, **42**, and **43**, respectively.

Still with reference to FIG. **2**, one of the two upper support rails **28**, **29** is electrically isolated from the remaining electrically conductive drawer structural elements. In FIG. **2**, the isolated rail is shown as right rail **29** with electrically non-conductive support inserts **45**, **46**. Thus, one rail (right rail **29**) of each drawer **18–21** is mechanically supported in the drawer but is electrically isolated from the rest of the conductive structural elements.

As seen in FIG. **2**, file folder **30** has the conventional U-shaped cross-sectional construction which has proven to be popular in the office equipment industry for containing documents. Each side (front and back) of folder **30** is mechanically supported by a mechanical brace. One of the braces (brace **48**) is of unitary construction and comprises a single rigid electrically non-conductive arm having downwardly folded hook-like ends which slidably engage the support rails **28**, **29**. The other brace (brace **50**) has a special construction according to the invention.

With reference to FIG. **3**, which is a front elevational view of brace **50**, this element includes a left arm **51**, a right arm **52**, and a central non-conductive support portion **55**. Arms **51** and **52** are both constructed from an electrically conductive material, such as steel, aluminum, or the like, and each has a downwardly turned hook-like end **56** which mechanically and electrically engages the associated one of rails **28**, **29** when the folder is properly positioned in the file drawer. An R.F. responsive electrical circuit **60** comprising a crystal **61**, a diode **62**, and an LED indicator **63** is mounted centrally of brace **50**. One terminal **64** of crystal **61** is electrically connected to arm **52**. The other terminal **65** of crystal **61** is electrically connected to one terminal of diode **62** and one terminal of LED **63**. The other terminals of diode **62** and LED **63** are electrically connected to arm **51**. Thus, electrical circuit **60** is electrically coupled between arms **51**, **52** so that circuit **60** is electrically coupled to rails **28**, **29** when file folder **30** is properly supported in file drawer **18**. LED **63** is mechanically supported by brace **50** in such a manner as to protrude above the upper margin of file folder **30** so that LED **63** is visible above the file folder when the file drawer **18** is opened.

FIG. **4** is a circuit diagram showing the interconnection between all folder circuits **60** in a single file drawer **18–21**, as well as the front panel indicator **27**. As seen in this Fig., each circuit **60-1**, **60-2**, . . . , **60**-n is electrically coupled across conductive support rail **28**, **29**. All circuits **60-1**, **60-2**, . . . , **60**-n are connected in parallel. Current detector circuit **40**, which comprises a switching transistor **71**, a diode **72**, a resistor **73**, a resistor **74**, and a capacitor **75**, all connected as shown, has a first node **76** coupled to one of the rails **28**, **29**, and a second node **77** coupled to the other one of rails **28**, **29**. A coil **78** is coupled between second node **77** and its associated rail. A capacitor **79** is coupled between the rail-side terminal of coil **78** and the common crystal input of circuits **60-1**, **60-2**, . . . , **60**-n.

Each crystal **61** in a given folder circuit has a resonant frequency different from that of the crystals in the other folder circuits. All resonant frequencies are preferably in the R.F. range of the spectrum, and may range in value from about 2 MHz. to about 12 MHz. The frequency separation between crystals is a matter of design choice, and good results have been obtained with crystals in the approximately 5,000 MHz range by using a minimum frequency separation of 0.001 MHz.

Although not illustrated, the associated computer has an R.F. signal generator which is electrically coupled in parallel to the folder circuits in all the file drawers. The R.F. signal generator is a mixed signal source which produces both an R.F. AC signal and a relatively low voltage (e.g. 9 volts) DC signal. The R.F. signal passes through capacitor **79** but is blocked by coil **78**. The DC signal passes through coil **78** but is blocked by capacitor **79**. The DC signal is used to operate transistor **71** in detector circuit **40** and indicator **27**.

When a signal having an R.F, component whose frequency matches the resonant frequency of a crystal **61** of one of the folders is present on conductor **28**, that crystal will resonate and present a low resistance to the passage of R.F. current through that branch of the circuit. The flow of R.F. current through that branch will cause the corresponding LED to be activated. The R.F. current also flows through common resistor **73** causing an R.F. voltage drop, and this voltage drop is rectified by diode **72**. This saturates transistor **71**, which enables DC current to pass through indicator **27**, transistor **71** and rail **29** back to the source. When DC current passes through indicator **27**, this element is activated.

FIG. **5** is a flow chart which illustrates the operation of the invention to find a single file folder. As seen in this Fig., the user enters the name of the desired file into the computer, typically using a keyboard or a mouse. The computer performs a table look-up of the resonant frequency for that particular file folder, turns on the R.F. signal generator, and causes an R.F signal of the correct frequency to be generated

and transmitted in parallel to all file drawer conductor rails **28**, **29**. The file folder circuit having the crystal of that frequency (if present in any of the drawers) will respond to the R.F. signal by illuminating the LED indicator for that circuit. All other file folder circuits will not respond to the particular frequency, so that the LED indicator of the correct folder will be the only one illuminated. In addition, the front panel indicator of the file drawer holding the correct file folder will be illuminated by the current detector circuit for that drawer so that the user need only open the correct drawer to retrieve the proper file.

The R.F. signal generator in the associated computer may comprise a sweep frequency generator capable of generating R.F. signals in a swept mode, beginning with the lowest crystal resonant frequency in the file management system, and ending with the highest crystal resonant frequency in the system. With such a signal generator, the integrity of the entire collection of files can be quickly checked by instructing the computer to activate the R.F. signal generator in the sweep mode. As the signal frequency is swept over the entire range, all folder circuits which are present in the collection of file cabinets will resonate at their respective frequency and this can be detected at the computer using a conventional R.F. detector circuit. Any missing file will not respond, and this also can be detected at the computer using the same circuit. Any files detected as missing can be correlated to the file identification in the computer by noting the frequency of the non-responsive folder circuits.

The system may be initially configured in several different ways. The most fundamental way is to place a single file folder **30** into a drawer, cause the R.F. signal generator to sweep the range of frequencies, note the frequency at which the crystal in that folder resonates, enter that frequency number into a list, remove the folder, insert another folder, and repeat this process for all folders desired on a serial basis. This method works well for a new system with no existing folders and a relatively small number of folders required initially. A more useful technique is to insert a first folder into a drawer, sweep the R.F. frequency, note the resonant frequency, enter that number into a new list; insert a second folder to the drawer without removing the first, sweep the frequency, add the resonant frequency of the new folder to the list; insert a third folder into the drawer, sweep the frequency, add the resonant frequency of the third folder to the list; etc. As each new folder is inserted into the drawer, the computer has a running list of frequencies already identified and, since each crystal frequency is unique, there can be no duplications. An even more sophisticated technique, and one which is most useful for existing file management systems having a large number of folders already in use, proceeds as follows. A requisite number of folders **30** sufficient to contain all existing types of documents in the file management system is distributed among a number of drawers. The R.F. generator is activated in the sweep mode, and each resonant frequency is detected and entered into a list by the computer. After all frequencies have been detected and entered, the computer initializes the R.F. generator and causes it to sweep all entered frequencies. As a given frequency is reached, the generator is locked to that frequency, the drawer and folder indicators **27**, **63** are activated, and a human operator manually places the associated documents into that particular folder and enters appropriate folder identification information into the computer (e.g., "Utilities Bills"). Once the identification information is entered for a given frequency and folder, the generator is activated to sweep to the next frequency in the list, and the generator is locked at that frequency until the documents are inserted into the folder and the folder information is entered into the computer. This process continues until all frequencies have been accounted for.

FIG. **6** illustrates an alternate embodiment of the file management system implementation of the invention disclosed and claimed in the '875 patent using wireless communication between the individual file cabinets and the associated computer. As seen in this Fig., cabinet **10** is provided with a transceiver **81** for communication with the associated computer. The associated computer is provided with a matching transceiver **82**. Operation of the FIG. **6** system is essentially identical to that of the FIG. **1** system, with the exception that the R.F. signals are transmitted to file cabinet **10** using transceivers **81**, **82**, rather that the hard wired connections of the FIG. **1** embodiment. In addition, there may be additional security considerations to the wireless embodiment of FIG. **6** to prevent unauthorized transmission and reception of the R.F. signals.

As will now be apparent, file management systems incorporating the invention of the '875 patent provide a number of significant advantages absent from the prior art. Firstly, since the '875 invention provides an automatic visible indication of the drawer and file folder containing the desired documents, the time to find and retrieve a file is significantly reduced. In addition, the integrity of the entire file system can be easily checked on a periodic or ad hoc basis in a relatively short period of time, and a list of missing files can be automatically compiled by the computer. Moreover, the use of visible indicators to signal the location of a specific file eliminates the need to separately identify each file by using specific descriptors attached to each file. Consequently, any unauthorized individual wishing to find a particular file containing information of a specific type by manually searching through the file drawers and file folders would be forced to review the contents of each individual file folder (as opposed to merely reading the file label found on prior art file folders), which adds a significant barrier to unauthorized review of file folder information. Still further, since the contents of a given file folder are independent of the file folder identification, any file can be reassigned to different information contents or renamed by using the computer to effect the changes. Stated differently, the file folder itself need not be physically altered in order to change the file folder designation. Thus, once a complete set of file folders is in place, there is no need to add new folders.

File management systems incorporating the '875 invention may also be modified using the computer to add new file folders, delete old file folders no longer considered necessary, and to rearrange the grouping of file folders.

Although the above description is devoted to an implementation in the field of file management systems, the '875 invention has much wider application. In general, the '875 invention can be used in any collective object management system in which the need exists for a technique for rapidly identifying a given class or type of object from a collection of objects. For example, in an automotive parts warehouse operation, the objects may be individual vehicle parts (such as carburetors, alternators, gaskets or the like) stored in bins on shelves. In a manufacturing operation, the objects may be the individual items manufactured in the plant (such as different types of integrated circuits manufactured by an integrated circuits manufacturer) contained in individual packages. In any application, the R.F. circuit and indicator associated to a specific object are closely coupled to the object itself and electrically coupled to the R.F. generator so that the circuits can respond to the reception of an R.F. signal of the correct frequency and activate the indicator in such a

way that a human operator can locate the object specified by the frequency (or the absence of such an object).

Although the above provides a full and complete disclosure of the preferred embodiments of the '875 invention, various modifications, alternate constructions and equivalents will occur to those skilled in the art. For example, while the '875 invention has been described with reference to specific R.F. frequencies, other frequencies may be employed, depending on the preferences of the system designer. Moreover, while the indicators **27**, **63** have been described as visible indicators, other types of indicators, such as audible indicators, may be used, if desired. In addition, while the '875 invention has been described with reference to a single file cabinet, it is understood that it may be implemented using multiple file cabinets positioned at the same or different locations in an office. Further, the '875 invention may be used to manage a file system of many cabinets positioned at different physical locations using an internal or an external computer network, if desired.

As noted above, many governmental agencies at either the local or national level provide legal restrictions on the amount and manner of r.f. energy radiation. The '875 invention may be subject to objection in use based on these governmental restrictions, even though it may pose no real danger to those in proximity to the file cabinets incorporating the '875 invention.

FIG. **7** is a block diagram of an improved r.f. circuit which avoids this disadvantage. As seen in this Fig., the improved r.f. circuit includes an r.f. separator **78**, a resonant circuit **61**, a drawer indicator **27**, and a folder indicator **63**, which are essentially identical to the same numbered elements described above. In addition, the improved r.f. circuit includes a latch **101** for storing the state of the resonant circuit **61**, and for generating a feedback signal on conductor **102** which is sent back to the r.f. generator and used to terminate the generation of an r.f. signal whenever the latch circuit **101** indicates that the particular resonant circuit **61** has responded to received r.f. radiation of the proper frequency. In operation, when resonant circuit is activated by the receipt of r.f. radiation of the proper frequency, latch circuit is set to the resonant state. This produces a logic signal of a particular level indicating that circuit **61** is at resonance. This signal is fed back to the r.f. generator and is used to terminate the operation of the r.f. generator. At the same time, latch circuit provides a logic signal of correct level to maintain both drawer indicator **27** and folder indicator **63** in the activated state, even though the r.f. circuit is no longer receiving an r.f. signal as an input. Both drawer indicator **27** and folder indicator **63** are maintained in the operational state until the folder is removed from the support rails, at which time the D.C. power to latch **101** is interrupted, thereby causing the latch **101** to revert to the opposite logical state.

FIG. **8** is a circuit diagram of the preferred implementation of the r.f. circuit of FIG. **7**. As seen in this Fig., latch **101** comprises an AND gate having a first input coupled to the cathode terminal of Diode **62**, and a second signal input coupled to the signal output of the AND gate. The AND gate further includes a Vcc input for receiving a D.C. voltage input for providing operating voltage to the AND gate. The output of the AND gate is coupled to the anode terminal of folder indicator **63**. The AND gate is preferably an NTE type 4071B or a Fairchild type MM74C02N-ND hardware component. A pair of capacitors **104**, **105** serve to filter out any r.f. signal component which might pass through separator **78**. Similarly, an additional r.f. separator **107** and capacitor **108** provide further r.f. filtering.

As will now be apparent, the invention permits the r.f. identification of individual folders in a filing system while eliminating any potential problem with r.f. radiation when a file drawer is opened by enabling the termination of r.f. generation after a resonant circuit **61** becomes activated while preserving the resonant indicating state of the indicators **27**, **63**.

While the invention has been described with reference to a particular implementation using a single AND gate, other particular implementations may be employed, such as one using a latching flip-flop. Therefore, the above should not be construed as limiting the invention, which is defined by the appended claims.

What is claimed is:

1. In a system for managing objects distributed in an object location space, said system comprising a receptacle for a plurality of objects, said receptacle having a pair of electrically conductive members; a pair of electrically conductive signal leads coupled to said pair of electrically conductive members; and a plurality of r.f. circuits each associated to a different one of said objects, each of said plurality of r.f. circuits having a pair of electrically conductive terminals in electrical contact with said electrically conductive members when the associated object is located in said receptacle, a crystal resonant at a specific frequency and an indicator activated whenever the associated crystal detects an r.f. signal at the specific frequency of that crystal, the resonant frequency of each of said crystals being different from the remaining ones of said crystals so that an r.f. signal applied to said pair of electrically conductive signal leads causes only one of said plurality of crystals to resonate and only the associated indicator to be activated; the improvement wherein each of said plurality of r.f. circuits includes a latch having an input coupled to the respective crystal and an output coupled to the associated indicator, said latch being responsive to the resonant state of said crystal for activating said indicator and for providing a resonant state feedback signal for terminating said r.f. signal.

2. The system of claim **1** wherein said indicator is a visible indicator.

3. The system of claim **2** wherein said visible indicator is an LED.

4. The system of claim **1** wherein said object location space comprises a file cabinet and wherein said objects are file folders.

5. In a system for managing objects distributed in an object location space, said system comprising a plurality of receptacles for a plurality of objects, each of said receptacles having a pair of electrically conductive members; a plurality of pairs of electrically conductive signal leads each coupled to a different one of said plurality of pairs of electrically conductive members, each of said plurality of pairs of electrically conductive signal leads being coupled in parallel to a common signal input terminal; and a plurality of r.f. circuits each associated to a different one of said objects, each of said plurality of r.f. circuits having a pair of electrically conductive terminals in electrical contact with one of said plurality of pairs of electrically conductive members when the associated object is located in one of said receptacles, a crystal resonant at a specific frequency and an indicator activated whenever the associated crystal detects an r.f. signal at the specific frequency of that crystal, the resonant frequency of each of said crystals being different from the remaining ones of said crystals so that an r.f. signal applied to said common input terminal causes only one of said plurality of crystals to resonate and only the associated indicator to be activated; the improvement wherein each of

said plurality of r.f. circuits includes a latch having an input coupled to the respective crystal and an output coupled to the associated indicator, said latch being responsive to the resonant state of said crystal for activating said indicator and for providing a resonant state feedback signal for terminating said r.f. signal.

6. The system of claim **5** wherein said indicator is a visible indicator.

7. The system of claim **6** wherein said visible indicator is an LED.

8. The system of claim **5** wherein said object location space comprises a file cabinet and wherein said objects are file folders.

9. For use in a system for managing objects distributed in an object location space having at least one receptacle with a pair of electrically conductive members; a plurality of r.f. circuits each associated to a different object, each of said plurality of r.f. circuits having a pair of electrically conductive terminals in electrical contact with said electrically conductive members when the associated object is located in said receptacle, a crystal resonant at a specific frequency and an indicator activated whenever the associated crystal detects an r.f. signal at the specific frequency of that crystal, the resonant frequency of each of said crystals being different from the remaining ones of said crystals so that an r.f. signal applied to said pair of electrically conductive members causes only one of said plurality of crystals to resonate and only the associated indicator to be activated; the improvement wherein each of said plurality of r.f. circuits includes a latch having an input coupled to the respective crystal and an output coupled to the associated indicator, said latch being responsive to the resonant state of said crystal for activating said indicator and for providing a resonant state feedback signal for terminating said r.f. signal.

10. The improvement of claim **9** wherein said indicator is a visible indicator.

11. The improvement of claim **10** wherein said visible indicator is an LED.

12. The improvement of claim **9** wherein said object location space comprises a file cabinet and wherein said objects are file folders.

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